

CLAIMS

What is claimed is:

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1. A method of printing a solder paste onto a substrate surface, the method comprising:
  - (a) placing a stencil over the substrate surface;
  - (b) printing the solder paste comprising a lubricant additive through the stencil; and
  - (c) removing the stencil from the substrate surface.
2. The method as set forth in claim 1 wherein the stencil is a stainless steel.
3. The method as set forth in claim 1 wherein the stencil is an electroformed stencil.
4. The method as set forth in claim 1 wherein the stencil has a thickness of about 0.10mm to about 0.150mm.
5. The method as set forth in claim 1 wherein the stencil has apertures of at least about 0.20mm and a pitch of at least about 0.40mm.
6. The method as set forth in claim 1 wherein the lubricant additive is selected from the group consisting of a fatty acid, a fatty alcohol, a fatty acid ester, a fatty alcohol ester, a mineral oil, a wax, a siloxane, a silicone and a micronised polytetrafluoroethylene powder.
7. The method as set forth in claim 6 wherein the lubricant additive is a branched chain fatty alcohol or fatty acid comprising 8 to 50 carbon atoms with a minimum of 4 carbon atoms being present in the shorter alkyl chain, or ester thereof.
8. The method as set forth in claim 7 wherein the branch point of the lubricant additive is at the second carbon position.

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5 9. The method as set forth in claim 8 wherein the lubricant additive is selected from the group consisting of 2-butyl-1-octanol, 2-butyl-1-decanol, 2-hexyl-1-octanol, 2-hexyl-1-decanol, 2-hexyl-1-dodecanol, 2-octyl-1-dodecanol, 2-decyl-1-tetradecanol, 2-butyloctanoic acid, 2-butyldecanoic acid, 2-hexyldecanoic acid, 2-hexyldodecanoic acid, 2-octyldodecanoic acid, 2-decyltetradecanoic acid and 2-hexadecyleicosanoic acid.

10. The method as set forth in claim 8 wherein the lubricant additive comprises:

an ester of a fatty alcohol, and  
a fatty acid, a dibasic acid or a tribasic acid.

11. The method as set forth in claim 10 wherein the lubricant additive ester is a stearate, an oleate, a palmitate, an isostearate, an adipate, a trimellitate, a thiodipropionate or an pentaerythritol ester.

12. The method as set forth in claim 1 wherein the solder paste comprises about 75% to about 95% by weight of a solder powder.

13. The method as set forth in claim 1 wherein the solder powder comprises about 85% to about 90% by weight of a solder paste.

14. The method as set forth in claim 1 wherein the solder powder has an average particle size in the range of from about 10 to about 80 micrometers.

15. The method as set forth in claim 1 wherein the solder powder has an average particle size in the range of from about 25 to about 45 micrometers.

16. The method as set forth in claim 12 wherein the solder powder is an alloy composition selected from the group consisting of SnPb alloys, SnPbBi alloys, SnBi alloys, SnPbAg alloys, SnAgCu alloys, SnAgCuBi alloys and SnZnBi alloys.

17. The method as set forth in claim 16 wherein the solder powder is a Sn37Pb63 alloy.

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18. The method as set forth in claim 16 wherein the solder powder is a Sn62Pb36Ag2 alloy.

19. The method as set forth in claim 1 wherein the solder paste comprises about 0.1 to about 2% by weight of the lubricant additive.

20. The method as set forth in claim 1 wherein the solder paste comprises a polar organic solvent.

21. The method as set forth in claim 20 wherein the polar organic solvent is a polyhydric alcohol selected from the group consisting of ethylene glycol, diethylene glycol, propylene glycol, sorbitol, pentaerythritol and derivatives thereof, butyl diglyme, dibutyl itaconate, di(propylene glycol) butyl ether, 2-ethyl hexyl diglycol,  $\gamma$ -butyrolactone, hexyl carbitol, N-methyl pyrrolidone, N-ethyl pyrrolidone, terpeneol and tetraglyme.

22. The method as set forth in claim 21 wherein the polar organic solvent is tri(propylene glycol) butyl ether.

23. The method as set forth in claim 1 wherein the solder paste comprises a thickener selected from the group consisting of polyacrylic acid, hydrogenated castor oil and derivatives thereof, polyamides and resins.

24. A method of printing a solder paste onto a substrate through a stencil wherein the solder paste comprises a lubricant additive to improve the release of the solder paste from the stencil, said lubricant additive comprising a branched chain fatty alcohol or fatty acid comprising 8 to 50 carbon atoms with a minimum of 4 carbon atoms being present in the shorter alkyl chain, or an ester thereof.

25. A solder paste comprising a solder powder and a non-aqueous vehicle, wherein the non-aqueous vehicle comprises a lubricant additive which is a branched chain fatty alcohol or fatty acid comprising 8 to 50 carbon atoms with a minimum of 4 carbon atoms being present in the shorter alkyl chain, or an ester thereof.

26. The solder paste as set forth in claim 25 wherein the branch point of the lubricant additive is at the second carbon position.

27. The solder paste as set forth in claim 26 wherein the lubricant additive is selected from the group consisting of 2-butyl-1-octanol, 2-butyl-1-decanol, 2-hexyl-1-octanol, 2-hexyl-1-decanol, 2-hexyl-1-dodecanol, 2-octyl-1-dodecanol, 2-decyl-1-tetradecanol, 2-butyloctanoic acid, 2-butyldecanoic acid, 2-hexyldecanoic acid, 2-hexyldodecanoic acid, 2-octyldodecanoic acid, 2-decyltetradecanoic acid and 2-hexadecyleicosanoic acid.

28. The solder paste as set forth in claim 25 wherein the lubricant additive comprises:

an ester of a fatty alcohol, and  
a fatty acid, a dibasic acid or tribasic acid.

29. The solder paste as set forth in claim 28 wherein the lubricant additive is a stearate, an oleate, a palmitate, an isostearate, an adipate, a trimellitate, a thiodipropionate or a pentaerythritol ester.

30. The solder paste as set forth in claim 25 wherein the solder powder comprises about 75% to about 95% by weight of a solder paste.

31. The solder paste as set forth in claim 25 wherein the solder powder comprises about 85% to about 90% by weight of a solder paste.

32. The solder paste as set forth in claim 25 wherein the solder powder has an average particle size in the range of from about 10 to about 80 micrometers.

33. The solder paste as set forth in claim 25 wherein the solder powder has an average particle size in the range of from about 25 to about 45 micrometers.

34. The solder paste as set forth in claim 25 wherein the solder powder is an alloy composition selected from the group consisting of SnPb alloys, SnPbBi alloys, SnBi alloys, SnPbAg alloys, SnAgCu alloys, SnAgCuBi alloys and SnZnBi

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alloys.

35. The solder paste as set forth in claim 25 wherein the solder powder is a Sn37Pb63 alloy.

36. The solder paste as set forth in claim 25 wherein the solder powder is a Sn62Pb36Ag2 alloy.

37. The solder paste as set forth in claim 25 wherein the lubricant additive comprises about 0.1 to about 2% by weight of the solder paste.

38. The solder paste as set forth in claim 25 wherein the non-aqueous vehicle comprises a polar organic solvent.

39. The solder paste as set forth in claim 38 wherein the polar organic solvent is a polyhydric alcohol selected from the group consisting of ethylene glycol, diethylene glycol, propylene glycol, sorbitol, pentaerythritol and derivatives thereof, butyl diglyme, dibutyl itaconate, di(propylene glycol) butyl ether, 2-ethyl hexyl diglycol,  $\gamma$ -butyrolactone, hexyl carbitol, N-methyl pyrrolidone, N-ethyl pyrrolidone, terpineol and tetraglyme.

40. The solder paste as set forth in claim 38 wherein the polar organic solvent is tri(propylene glycol) butyl ether.

41. The solder paste as set forth in claim 25 wherein the non-aqueous vehicle comprises a thickener selected from the group consisting of polyacrylic acid, hydrogenated castor oil and derivatives thereof, polyamides and resins.

42. The solder paste as set forth in claim 41 wherein the thickener comprises no more than about 30 percent by weight of the non-aqueous vehicle.

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